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Hofmann et al.

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(54) **TRANSPORT SYSTEM FOR TRANSPORTING ITEMS TO BE SOLDERED THROUGH A SOLDERING SYSTEM, AND SOLDERING SYSTEM**

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CPC ***B23K 1/008*** (2013.01); ***B23K 3/08*** (2013.01); ***B23K 37/047*** (2013.01); ***F27B 9/00*** (2013.01);
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(58) **Field of Classification Search**
CPC B23K 1/008; B23K 3/08; B23K 37/04; B23K 37/047; F27B 9/00; F27D 2003/0059; F27D 2003/0072
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(57) **ABSTRACT**

A transport system (**34**) for transporting soldering material through a soldering apparatus (**10**), includes a transport track (**38**, **40**) extending in a transport direction (**18**). The transport track includes transport rails (**42**, **44**, **46**, **48**). Coupling elements (**72**, **120**) are provided on a transport rail (**42**, **44**, **46**). The coupling elements include guide elements (**58**, **60**, **61**) which interact with transverse rods (**46**) that extend in a transverse direction (**54**) relative to the transport direction. Each coupling element includes a guide part (**100**) having the respective guide element (**58**, **60**, **61**) and a fastening part (**102**) fastened to the respective transport rail such that the fastening part can be displaced relative to the guide part so
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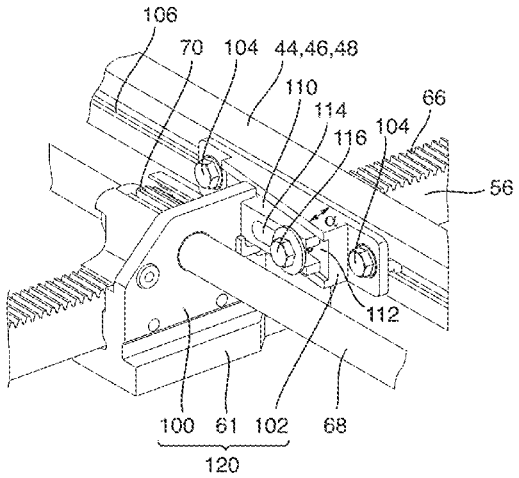

that the distance in the transverse direction between the transport rail and the respective guide part changes.

10 Claims, 7 Drawing Sheets

(51) **Int. Cl.**

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F27B 9/00	(2006.01)
F27D 3/00	(2006.01)

(52) **U.S. Cl.**
CPC *F27D 2003/0059* (2013.01); *F27D 2003/0072* (2013.01)

(58) **Field of Classification Search**
USPC 228/43, 47.1, 49.5, 179.1–180.22
See application file for complete search history.

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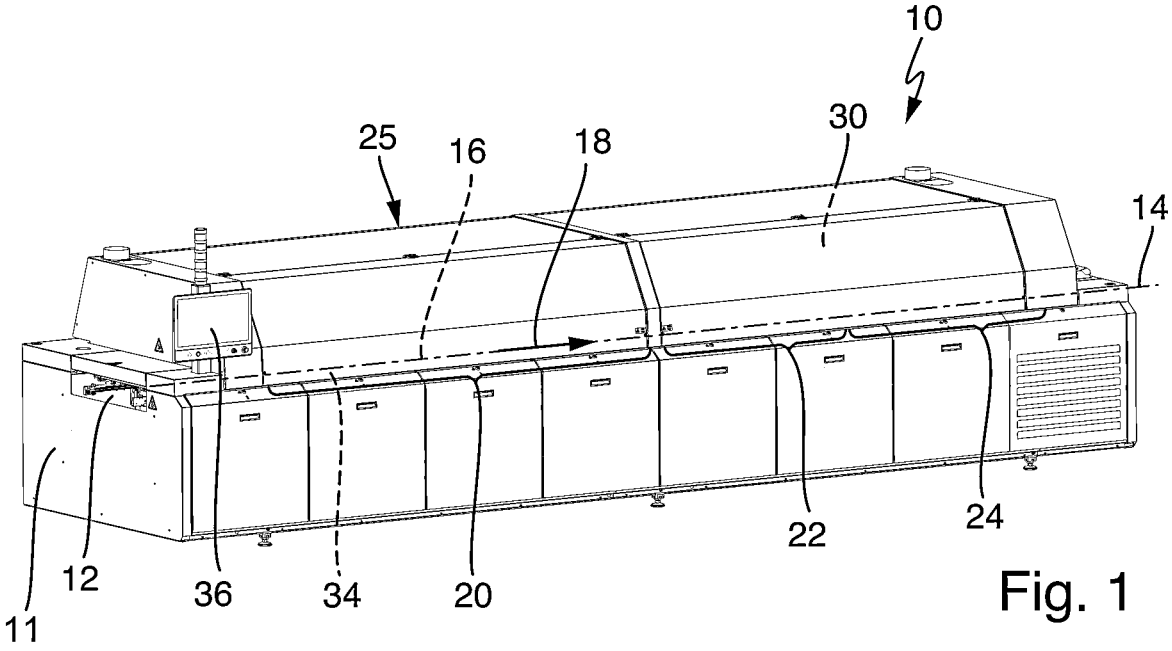

Fig. 1

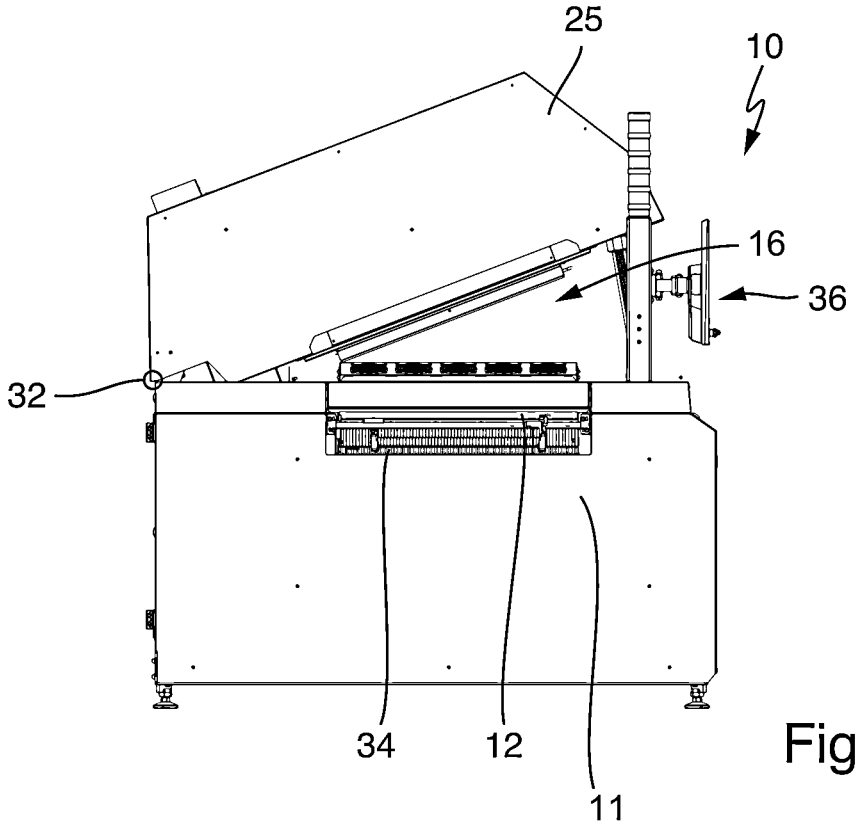

Fig. 2

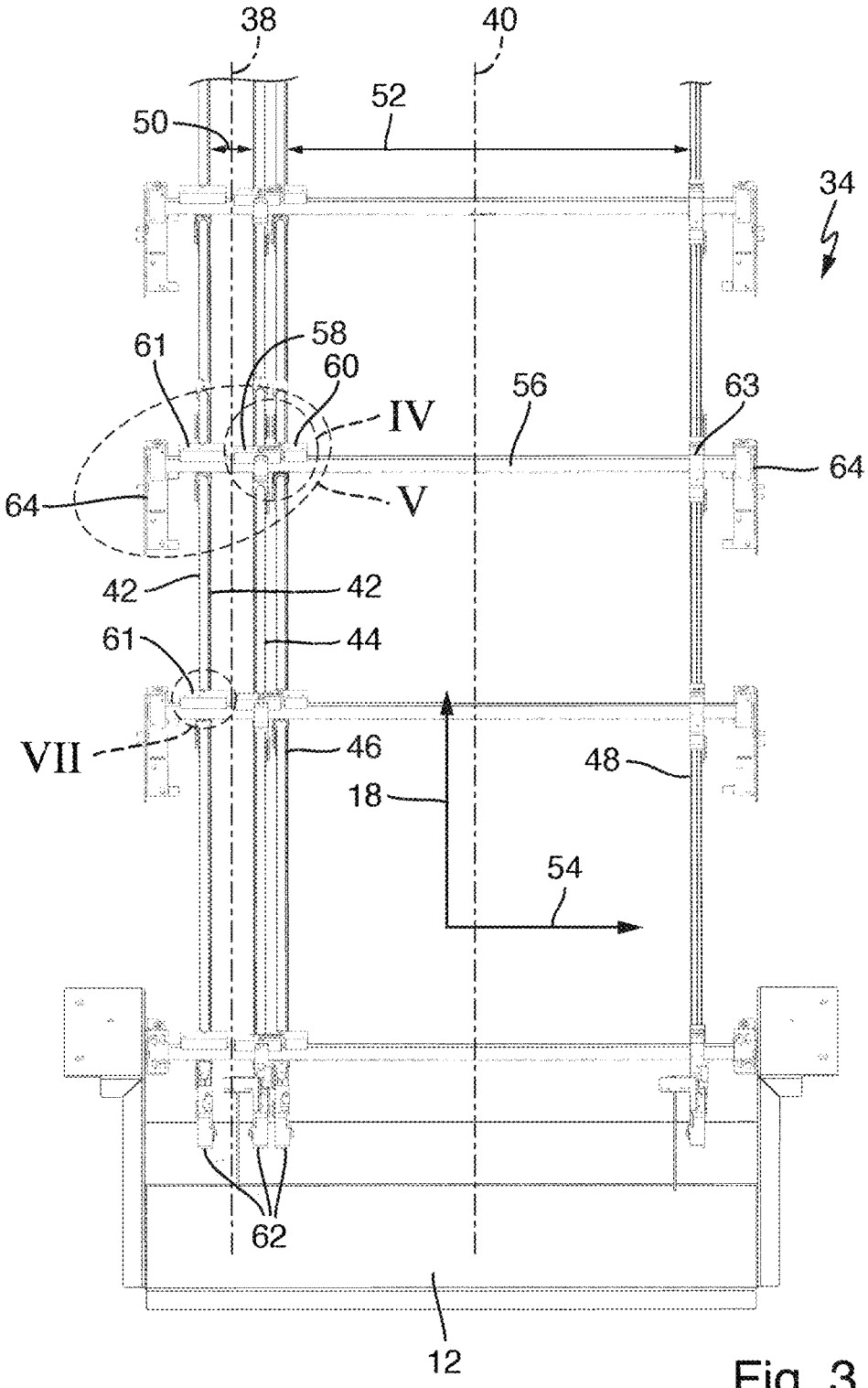
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Fig. 3

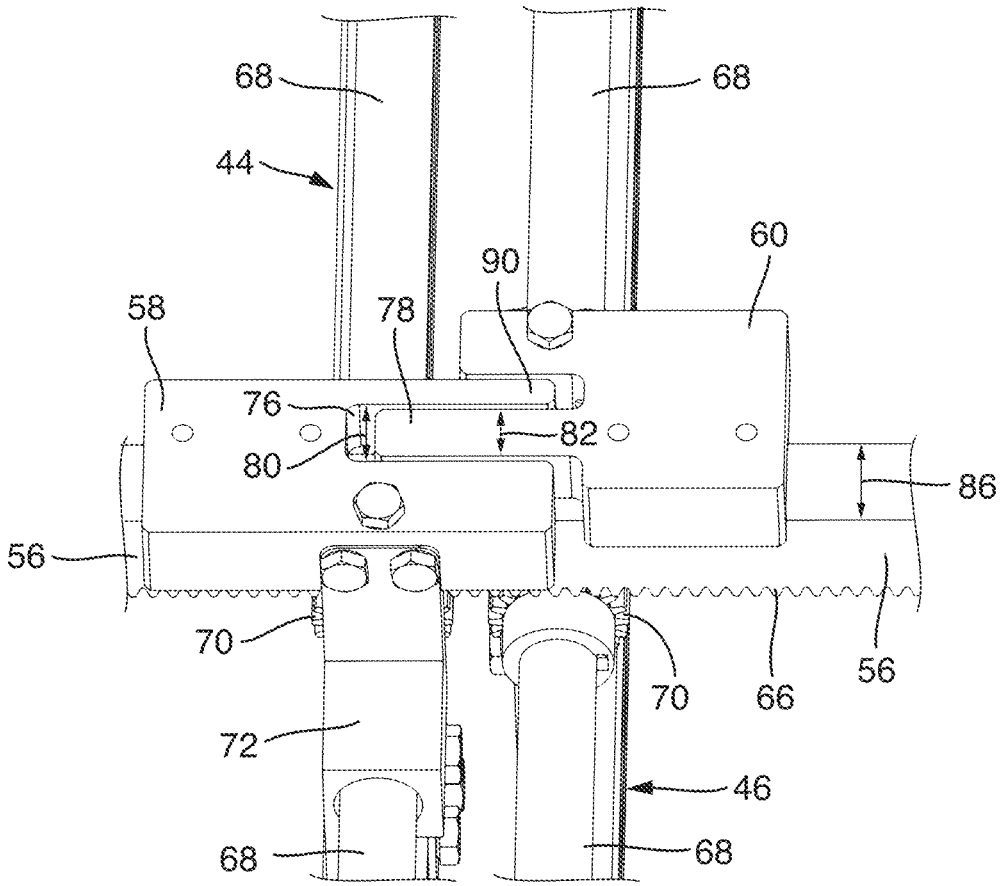

Fig. 4

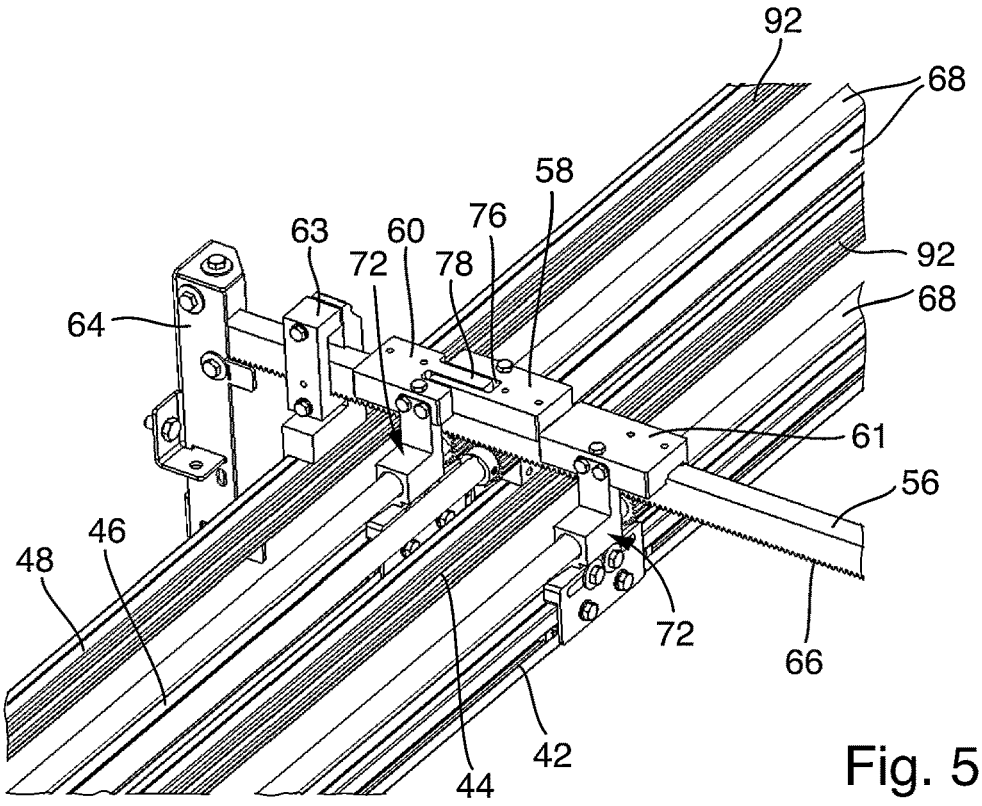
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Fig. 5

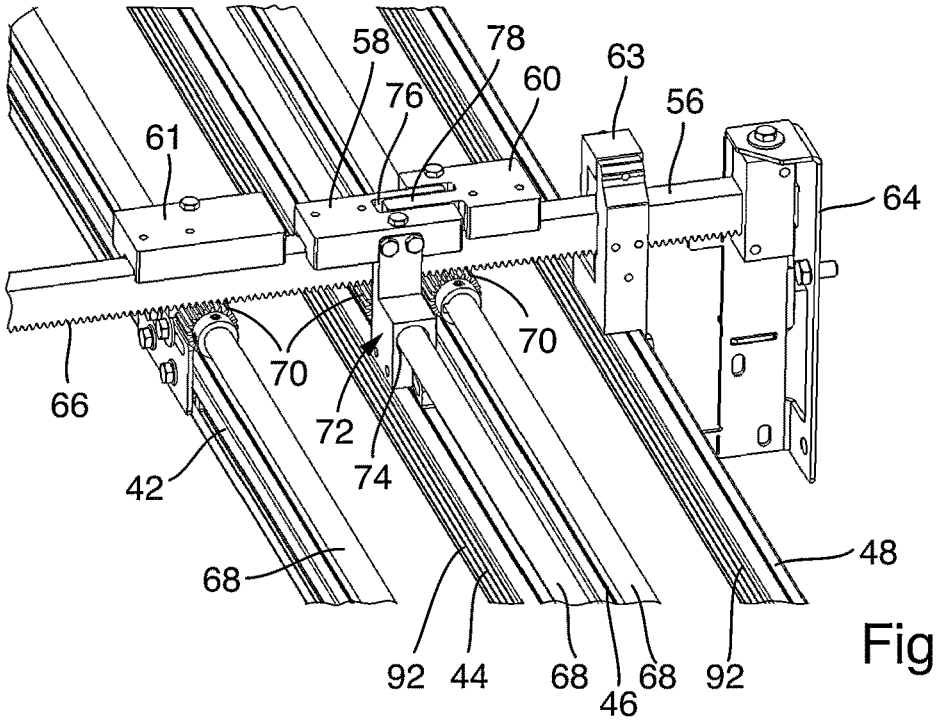
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Fig. 6

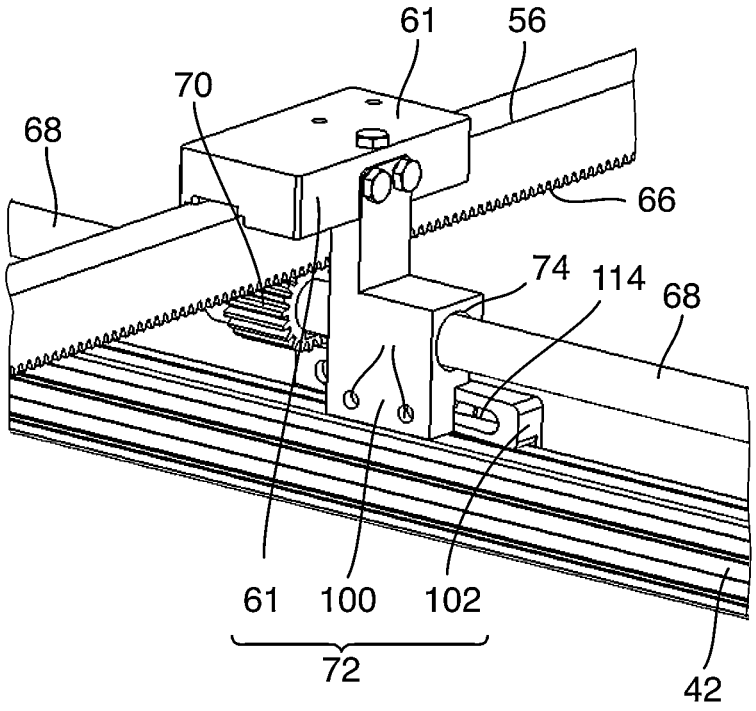
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Fig. 7

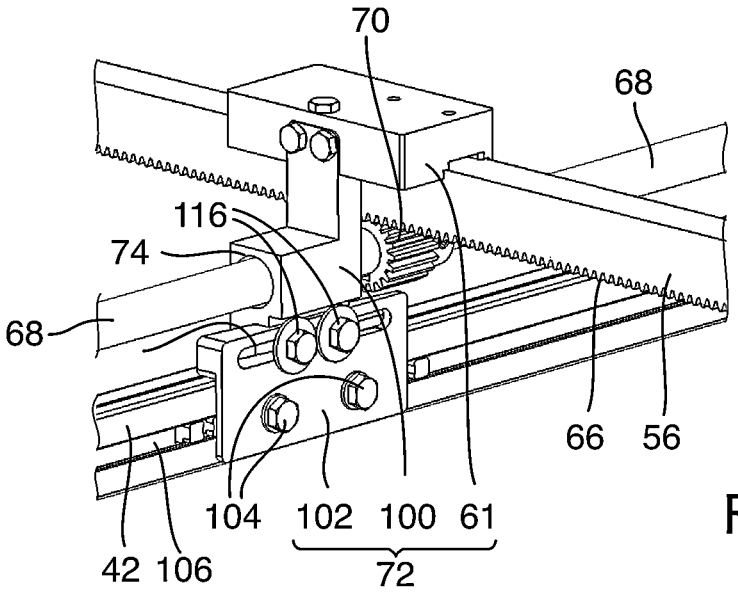
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Fig. 8

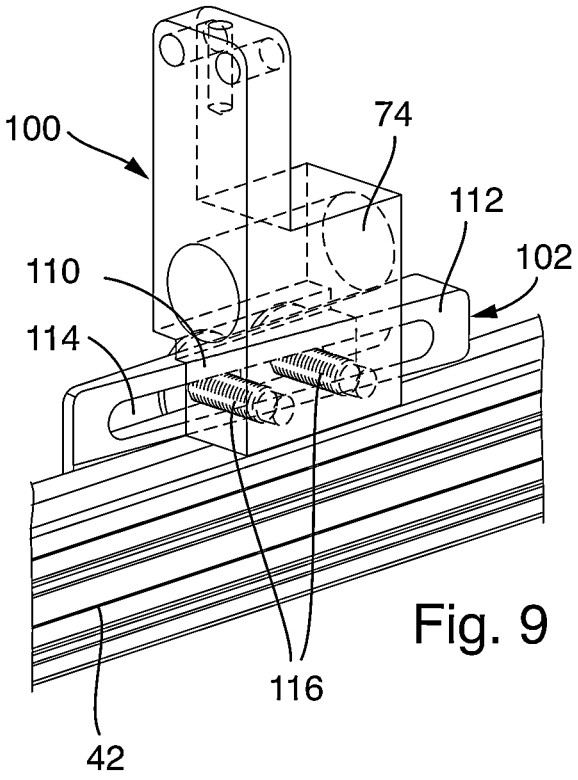

Fig. 9

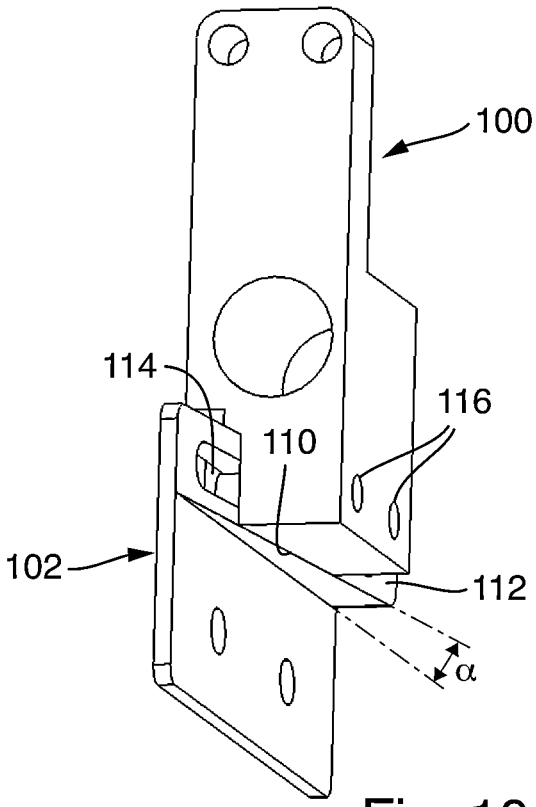

Fig. 10

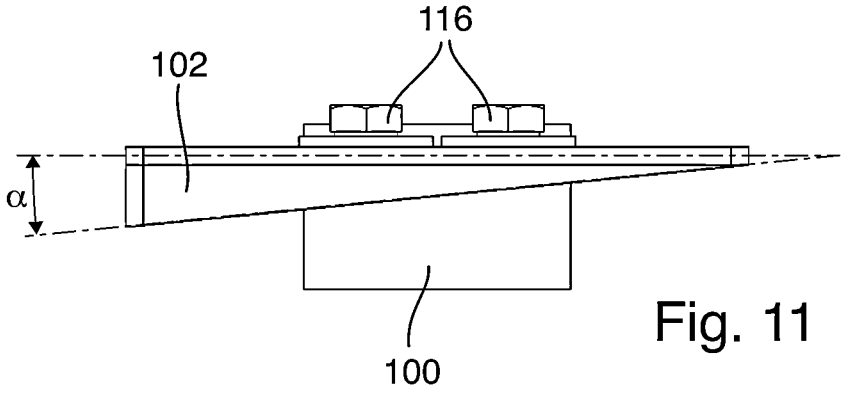

Fig. 11

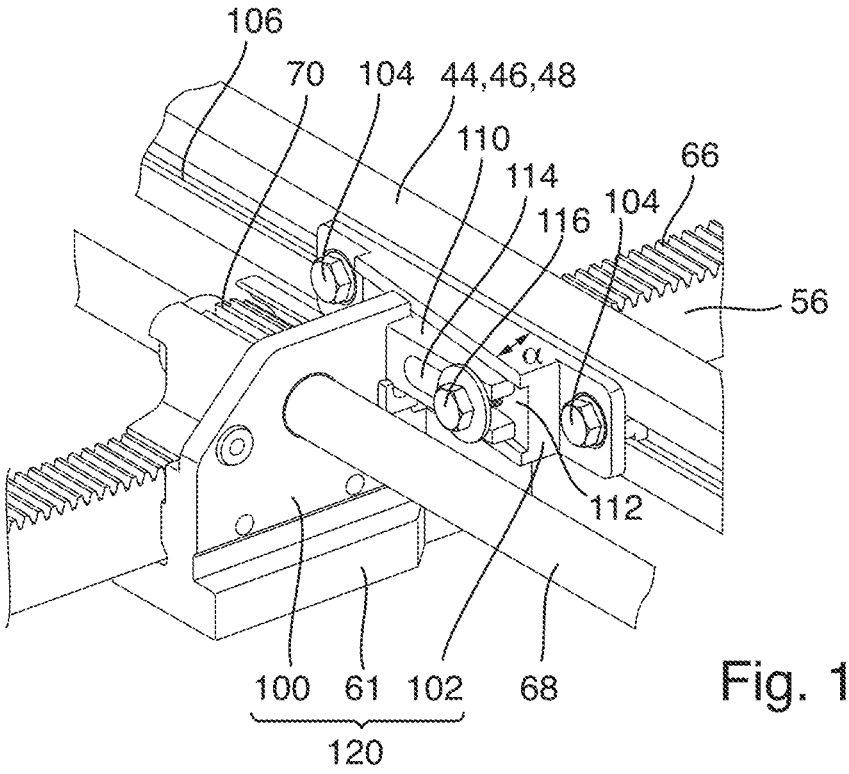
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Fig. 12

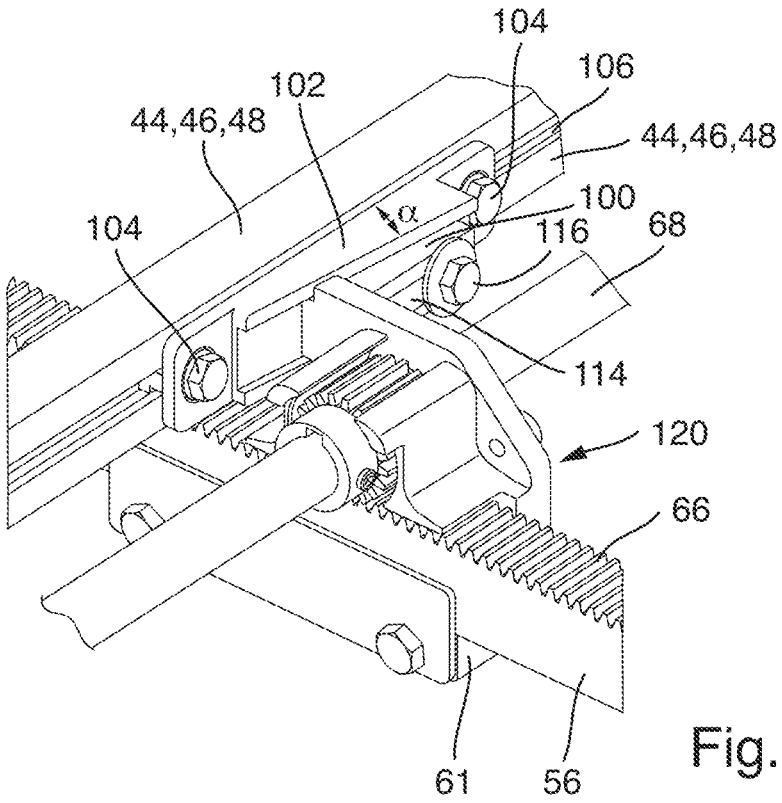
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Fig. 13

TRANSPORT SYSTEM FOR TRANSPORTING ITEMS TO BE SOLDERED THROUGH A SOLDERING SYSTEM, AND SOLDERING SYSTEM

The invention relates to a transport system for transporting soldering material through a soldering apparatus with at least one transport track extending in the transport direction, wherein the transport track comprises at least two transport rails. The soldering material can take the form of a printed circuit board populated with electronic components or of a goods carrier for goods, and in particular for printed circuit boards populated with electronic components. The soldering apparatus can in particular be a reflow soldering apparatus for the continuous soldering of printed circuit boards populated with electronic components or be a drying system for drying populated printed circuit boards.

Such transport systems generally grip the respective soldering material at the edges running parallel to the transport direction and convey said soldering material in the transport direction by means of transport rails, in which, for example, chain conveyors run. The transport rails can have a length of several meters and be composed of a plurality of rail sections. Such transport rails are also referred to as transport bars. Furthermore, it is known to provide, in addition to the two outer transport rails supporting the soldering material at the edges, a further transport rail for a central support supporting the soldering material in the central region. Central supports are advantageous in particular when comparatively large printed circuit boards or goods carriers are soldered or dried. They prevent the soldering material from bending or sagging in the central region, which can occur, in particular, due to the heating of the soldering material, and therefore ensure functionally reliable transport.

The invention also relates to a soldering apparatus, in particular a reflow soldering apparatus for the continuous soldering of populated printed circuit boards or a drying system for drying populated printed circuit boards in which soldering material can be transported along a transport direction.

Reflow soldering apparatuses can be used to solder what are known as SMD components (surface-mounted devices) onto the surface of printed circuit boards by means of soldering paste. The soldering paste, which is in particular a mixture of metal solder granules, flux and pasty components, is applied or printed onto the surface of the printed circuit boards for reflow soldering. Subsequently, the components to be soldered are placed into the soldering paste. In the reflow soldering process, the soldering material, i.e., the assembly consisting of a printed circuit board, soldering paste and components to be soldered, is preheated along the process channel in a preheating zone, and heated in a soldering zone to a temperature above the melting point of the soldering paste. As a result, the soldering paste melts, and the soldering joints are formed. In a cooling zone, if one is present, the soldering material is cooled until the melted solder solidifies before being removed from the reflow soldering apparatus.

In reflow soldering apparatuses, the process channel is generally formed by two channel halves, one upper and one lower channel half. The lower channel half is provided in or on a base body, and the upper channel half is provided in or on a hood. Further components such as, for example, nozzle plates, fan units, air ducts conducting the process gas, filter elements and/or cooling elements, are generally provided in or on the process channel, or in or on the base body and in or on the hood. Overall, a desired temperature profile is thereby provided along the transport direction in the process channel, wherein the process gas is blown into the process channel, sucked out therefrom, in particular cooled in the cooling zone, cleaned, and fed back to the process channel.

Soldering systems having transport units for transporting soldering material are known from DE 10 2019 128 780 A1 and DE 10 2005 055 283 A1. Furthermore, it is known from DE 10 2019 125 981 A1 to provide a transport system for transporting soldering material through a soldering apparatus having two transport tracks running parallel to one another and extending in the transport direction, wherein each of the transport tracks comprises at least two transport rails running parallel to one another and extending in the transport direction. In order to be able to accommodate different sizes and, in particular, different widths of soldering material, it is also known that the transport tracks are designed to be width-adjustable transversely to the transport direction.

U.S. Pat. No. 6,032,788 A discloses a multi-rail transport system for transporting printed circuit boards along adjacent rail pairs with first and second brake rods with parallel longitudinal axes and a plurality of brake cylinders.

It has been shown that, especially when the transport tracks are comparatively long, setting the parallelism of the transport rails over their longitudinal extension is not readily possible. Setting the parallelism of the transport rails is particularly difficult if they are designed to be width-adjustable for transporting soldering material of different widths.

The object of the invention is to provide a transport system for transporting soldering material through a soldering system and a soldering system with a transport system, in which setting the parallelism of the individual transport rails is possible in a functionally reliable manner in the simplest possible manner.

This object is achieved by a transport system having the features of claim **1**. Consequently, it is provided, in particular, that a plurality of coupling elements are provided on at least one transport rail, wherein the coupling elements comprise guide elements which interact with transverse rods which extend in a transverse direction running transversely to the transport direction, and wherein the coupling elements each comprise a guide part having the respective guide element and a fastening part fastened to the respective transport rail. The design is such that the fastening part is adjustable relative to the guide part, so that the distance in the transverse direction between the transport rail and the respective guide part changes.

Due to the fact that the coupling parts each comprise two components which can be adjusted relative to one another and can be fixed to one another, namely the guide part and the fastening part, it is possible in a simple manner to adjust the individual transport rails in the region of the respective guide part in the transverse direction. Such an adjustment of the respective fastening part and thus of the associated guide part in the transverse direction can take place in all coupling elements until the respective transport rail is optimally aligned in the longitudinal direction. For the adjustment of the guide parts or fastening parts, they are then preferably to be fixed. Overall, very long transport rails which can extend over five, ten or more meters can thereby also be aligned comparatively easily.

The process must be performed at least during installation or setup of the transport system. If, as a result of the operation of the transport system, a transport rail becomes misaligned at one or more locations in the longitudinal

direction, this can be remedied in a simple manner by correspondingly resetting or readjusting the fastening part and thus the guide part.

The at least one transport rail to be adjusted can be a transport rail which supports the soldering material at its edges or also a transport rail which serves for central support.

Furthermore, it is provided that the fastening parts are arranged on the respective transport rail in an axially adjustable and fixable manner and if the fastening parts each have an actuating section and the guide parts each have a counter-section interacting with the associated actuating section. The actuating section and/or the counter-section enclose an acute angle with the transport direction, so that the distance in the transverse direction between the transport rail and the respective guide part changes when the fastening part is adjusted axially. The arrangement is in particular such that the transverse rods are arranged in a stationary manner. By axially adjusting the fastening part on the respective transport rail, the transport rail is consequently adjusted in the transverse direction in the region of the fastening part. The axial movement of the fastening element is converted into a transverse movement due to the acute angle which the actuating section or the counter-section sets with the transport direction. Depending on the size of the acute angle, the transmission ratio consequently changes from the axial movement of the fastening element to the adjustment of the rail in the region of the respective fastening element in the transverse direction. Consequently, only the respective fastening part is actively adjusted; the associated guide part is automatically adjusted.

It is advantageous here if the respective actuating section bears at least in sections against the respective counter-section in a displaceably guided manner.

Furthermore, it is advantageous if the respective actuating section or the respective counter-section has a sliding receptacle for the respective sliding section or the respective actuating section. The sliding receptacle may, in particular, have a groove-like design. The sliding receptacle may also have undercuts and/or have a dovetail-like design in order to achieve a suitable movement coupling between the respective movement rail and the associated guide part.

Furthermore, it is conceivable that the respective actuating section or the respective counter-section has an elongated hole extending in the transport direction, which elongated hole can be open at the edge in the longitudinal direction of the elongated hole or can be closed at the edge. A fixing element for fixing the respective guide part to the respective fastening part, after corresponding adjustment of the fastening part in the axial direction, is advantageously provided in the respective elongated hole. The fastening part is, in particular, designed such that, in a release position, it allows the fastening part to be adjusted in the axial direction and that it fixes the respective guide part on the fastening part in a fixing position, when the respective transport rail is aligned in the longitudinal direction.

The fixing element may be designed, in particular, as a fastening screw. A screw of this type may have a thread which can be screwed into the guide part or fastening part. The fastening screw may also have a screw head which, in the fixing position, presses the fastening part against the guide part.

Furthermore, it is advantageous if, for the width adjustment of the at least one transport track, at least one of the width transport rails is adjustable in a transverse direction running transversely to the transport direction, wherein guide elements adjacent in the transverse direction of transport rails adjustable in the transverse direction are each guided on the same transverse rod so as to be displaceable toward and away from one another in the transverse direction. A transport rail can thereby be adjusted parallel to the other transport rails over its entire length parallel to the other transport rails in a simple manner.

According to one embodiment of the invention, it is provided that, in particular between the transport rails and the transverse rods, rotatably drivable rotary rods running parallel to the transport rails are provided, that the coupling elements each have a rotary receptacle for the respective rotary rod, and that the transverse rods have a toothing on their side facing the respective transport rail, which toothing meshes with gear wheels provided on the respective rotary rods. By rotating the individual rotary rods, the associated transport rails can consequently be displaced in the transverse direction. In order to achieve a uniform displacement over the entire length of the transport rails, the transverse rails have a toothing that meshes with gear wheels provided on the rotary rods. In other words, if the respective rotary rod is rotated, it is ensured that the associated transport rod is uniformly adjusted over its entire length parallel to the transport direction. The respective transport rail is guided in a functionally reliable manner by the respective associated coupling elements or the associated guide elements on the respective transverse rods.

Furthermore, it is conceivable that on the respective free end of the respective rotary rod a motor for rotatably driving the respective rotary rod is provided. During the width adjustment of the individual transport rails, the motors then move together with the respective transport rail. Overall, a compact design can thereby be achieved.

Furthermore, it is advantageous if drivable transport chains are provided on which preferably the edges of the soldering material and of the transport along the transport direction come to rest, wherein the transport chains run at least in portions inside the transport rails. For this purpose, the transport rails can be designed, for example, as profile elements.

The aforementioned object is also achieved by a soldering apparatus, in particular a reflow soldering apparatus or a drying system, in which soldering material can be transported along a transport direction, wherein such a soldering apparatus provides a transport system according to the invention.

Further details of the invention can be found in the following description, on the basis of which an embodiment of the invention is described and explained in more detail.

In the drawings:

FIG. **1** is a side view of a reflow soldering apparatus;

FIG. **2** is a front view of the reflow soldering apparatus according to FIG. **1**;

FIG. **3** shows a detail of a transport system of the soldering apparatus according to FIG. **1** and FIG. **2**;

FIG. **4** shows an enlarged detail IV from FIG. **3**;

FIG. **5** shows an enlarged detail V from FIG. **3**;

FIG. **6** is another perspective view according to FIG. **5**;

FIG. **7** shows an enlarged detail VII from FIG. **3**;

FIG. **8** is another perspective view according to FIG. **7**;

FIG. **9** is a perspective view of the coupling element shown in FIGS. **7** and **8**;

FIG. **10** is another perspective view of the coupling element according to FIG. **9**;

FIG. **11** is the plan view of the coupling element according to FIGS. **9** and **10**;

FIG. **12** is a view of an embodiment corresponding to the detail according to FIGS. **7** and **8** with different coupling element; and

FIG. **13** shows the detail shown in FIG. **12** in another perspective view.

FIG. **1** shows a reflow soldering apparatus **10** for the continuous soldering of soldering material. The reflow soldering apparatus **10** has an entry **12** and an exit **14**, wherein the soldering material that is to be soldered reaches the reflow soldering apparatus **10** via the entry **12** and is discharged from the reflow soldering apparatus **10** via the exit **14**. The soldering material is transported along a transport direction **18** through a process channel **16** indicated in FIG. **1**. A preheating zone **20**, a soldering zone **22** and a cooling zone **24** are provided in the process channel **16**.

As is clear from FIGS. **1** and **2**, a communications unit **36** is provided with a display screen and an input device by means of which it is possible to communicate with a machine controller of the reflow soldering apparatus **10**.

The soldering material, that is to say the printed circuit board provided with the soldering paste and populated with electronic components, is first heated in the preheating zone **20** to a temperature which is below the melting temperature of the soldering paste. In the soldering zone **22**, the printed circuit board is heated for a certain duration to a process temperature which is above the melting point of the soldering paste so that it melts in the soldering zone in order to solder the electronic components to the printed circuit board. In the cooling zone **24**, the soldering material is cooled such that the liquid solder solidifies before the soldering material is removed at the exit **14** of the reflow soldering apparatus **10**.

A transport system **34** is provided inside the reflow soldering apparatus **10** for transporting the printed circuit boards along the transport direction **18**.

As is also clear from FIG. **2**, the reflow soldering apparatus **10** has a base body **11** and a cover hood **25**. The cover hood **25** can be pivoted open about a hood axis **32** extending parallel to the transport direction **18**. By the cover hood **25** pivoting open, the interior of the process channel **16** and the transport system **34** becomes accessible in order to check visually, maintain, clean, set up, replace, and optionally repair them.

FIG. **3** is a plan view of a detail of the transport system **34**. The transport system **34** comprises two transport tracks **38** and **40** running parallel to one another in the transport direction **18**. The two transport tracks **38** and **40** are each delimited by two transport rails **42**, **44** and **46**, **48**. It would be conceivable for a central support having a further transport rail for supporting the soldering material in the central region to be provided between the transport rails **42**, **44** and **46**, **48**.

For adjusting the width **50** of the transport track **38** or the width **52** of the transport track **40**, the adjacent transport rails **44** and **46** of the two transport tracks **38** and **40** are adjustable in the transverse direction **54**. Furthermore, the transport rail **42** is adjustable in the transverse direction **54**. In the embodiment shown, the transport rail **48** is not adjustable in the transverse direction **54**. In the setting of the transport system **34** shown in FIG. **3**, the track **40** is set with its width **52** comparatively wide and the track **38** is set with its width **50** comparatively narrow.

As is clear from FIG. **3**, transverse rods **56** extending in the transverse direction **54** are provided, which transverse rods are provided, in particular, for guiding and holding the transport rails **42**, **44**, **46** that are adjustable in the transverse direction **54**.

In order to adjust the central transport rails **44** and **46**, a plurality of coupling elements **72** are provided on each of the transport rails **44** and **46**, each of which comprises guide elements **58** and **60**. The transport rail **42** also provides coupling elements **72** having guide elements **61**. For guiding the transport rails **42**, **44**, **46**, the guide elements **58**, **60**, **61** rest with their underside on the upper side of the respective transverse rods **56**. As is clear from FIG. **3**, the guide elements **58**, **60** and **61** of different transport rails **44**, **46**, which guide elements are adjacent in the transverse direction **54**, are each displaceable in the transverse direction **54** on the same transverse rod **56**. The free ends of the transverse rods **56** are each fixed with supports **64** in a stationary manner inside the soldering apparatus **10**.

As is clear from FIGS. **4**, **5** and **6**, the transverse rods **56** each have a toothing **66** on their lower side facing the transport rails **42**, **44**, **46**. The upper side of the transverse rods **56** is flat such that the guide elements **58**, **60** and **61** can be guided slidingly thereon.

In this case, rotatably drivable rotary rods **68** running parallel to the transport rails **42**, **44**, **46** are provided between the transport rails **42**, **44**, **46** and the transverse rods **56**. A plurality of identical gear wheels **70** that mesh with the toothings **66** of the transverse rods **56** are each provided on the rotary rods **68**.

The coupling elements **72** are fastened to the transport rails **42**, **44**, **46** and each comprise the guide element **58**, **60** and **61** as well as a rotary receptacle **74** for rotatably receiving the respective rotary rod **68**.

As is clear from FIG. **3**, motors **62** with which the rotary rods **68** can be rotatably driven are provided at the free ends of the rotary rods **68** in the region of the entry **12**. The arrangement is such that by rotating the rotary rods **68** or the gear wheels **70**, the transport rails **42**, **44**, **46** can be adjusted toward or away from one another in the transverse direction **54** on the transverse rails **56**. In contrast, the transport rail **48** is fastened to the transverse rod **56** in a clamping manner by means of a plurality of clamping elements **63**.

In order to ensure that the two central transport rails **44**, **46** can be moved toward one another as far as possible without the transport rails **44**, **46** being hindered by the guide elements **58**, the guide elements **58**, **60** of the two central transport rails **44** and **46** have a special design.

As is clear from FIGS. **4**, **5** and **6**, the guide element **58** has a recess **76** that extends in the transverse direction **54** and is designed in such a way that a projection **78** extending likewise in the transverse direction **54** on the respective associated guide element **60** can engage in the respective recess **76**.

FIG. **4** shows how the projection **78** engages in the recess **76**. The projection **78** is formed complementarily to the recess **76**. Due to the provision of the recess **76** or of the projection **78**, the two adjacent transport rails **44**, **46** can be moved toward one another as far as possible, wherein secure guidance of the transport rails **44**, **46** by the guide elements **58**, **60** on the respective transverse rod **56** is nevertheless ensured.

Both the recess **76** and the projection **78** are designed in such a way that they have a width **80**, **82** in the transport direction that is in each case smaller than the width **86** of the transverse rods **56** extending in the transport direction **18**.

As is clear in particular from FIG. **4**, it is also conceivable for at least one of the guide elements **60** to have not only a projection **78** but also a recess **88** for a projection **90** provided on the other guide element **58**. It is important that the design is such that the adjacent transport rails **44**, **46** of different transport tracks **38**, **40** can be moved toward one

another as far as possible without being hindered by the guide elements **58**, **60**, specifically in such a way that the guiding of the transport rods **44**, **46** by the guide elements **58**, **60** is not adversely affected thereby.

As is clear in particular from FIGS. **5** and **6**, the guide elements **61** of the one outer transport rail **42** are cuboid.

It can be seen from FIGS. **5** and **6** that the transport rails **42**, **44**, **46** and **48** are designed as half-profiles **92** in which drivable transport chains are provided onto which the free edges of the soldering material can be placed for transport through the soldering apparatus **10**.

In particular before the transport system **34** is put into operation, it is necessary to align the individual transport rails **42**, **46**, **44**, **48** precisely in the transport direction or parallel to one another. The outer transport rail **48**, which is not adjustable via the rotary rods **68**, can be aligned over its length by means of the clamping elements **63**. The clamping elements **63** can be adjusted on the transverse rods **56** in the transverse direction **54** and ultimately fixed.

Such a setting of the rails **42**, **44**, **46**, which can be adjusted in the transverse direction **54**, is not readily possible due to the provision of the rotary rods **68** and the gear wheels **72** that mesh with the transverse rods **66**. In order nevertheless to be able to align these transport rails **42**, **44**, **46** precisely parallel in the transport direction, it is provided that the coupling elements **72** each have a guide part **100** on which the respective guide element **58**, **60**, **61** is fastened, and a fastening part **102** that is fastened to the respective transport rail **42**, **44**, **46** in such a way that the respective fastening part **102** is designed to be adjustable and fixable relative to the associated guide part **100** in the transverse direction **54**. By adjusting the fastening part **102** relative to the guide part **100** in the transverse direction **54**, the respective transport rail **42**, **44**, **46** can consequently be aligned in the transport direction **54**.

In FIG. **7** and FIG. **8**, which each show the transport rail **42** in isolation with the associated coupling element **72**, it becomes clear that the coupling elements **72** are formed from the fastening part **102** fastened to the transport rail **42** and the guide part **100**, wherein the associated guide element **61** is arranged on the respective guide part **100**.

The coupling elements **72**, which are provided on the transport rails **44** and **46**, have a corresponding, at least two-part design, in each case having a fastening part **102** and a guide part **100**, such as the coupling elements **72** shown in FIGS. **7** and **8**.

As is clear in particular from FIG. **7**, the fastening parts **102** are axially adjustable on the respective transport rail **42**, **44**, **46** in the transport direction **18**. For fastening, fastening screws **104** are provided that correspond to slot nuts that are displaceably guided in an axial groove **106** on the respective transport rail **42**, **44**, **46**. By releasing the screws **104**, the respective fastening part **102** is consequently displaceable in the axial direction. By tightening the screws **104**, the respective fastening part **102** is fastened in place on the respective transport rail **42**, **44**, **46**.

As is clear in particular from FIGS. **9** to **11**, the respective fastening part **102** has an actuating section **112** and the respective guide part **100** has a counter-section **110** interacting with the actuating section **112**. The respective actuating section **112** and the associated counter-section **110** are formed lying flat against one another and enclose an acute angle α with the transport direction **18**, as becomes clear from FIG. **11**. It is thereby achieved that the adjustment of the fastening part **102** in the axial direction is accompanied by a deflection of the respective transport rail **42**, **44**, **46** in the region of the respective coupling element **72** in the transverse direction **54**. The transport rail **42**, **44**, **46** is consequently pushed away in the transverse direction **54** by the wedge-like actuating section **112** or counter-section **110** during the axial adjustment of the fastening part **102**. Because a plurality of coupling elements **72** are provided in the transport direction **18**, as becomes clear from FIG. **3**, the respective transport rail **42**, **44**, **46** can be aligned in parallel with the transport direction **18** over its longitudinal extension.

In the embodiment shown in FIGS. **7** to **11**, the respective actuating section **112** has an elongated hole **114** extending in the axial direction, in which elongated hole fixing elements **116** in the form of fastening screws are provided, by means of which, after the respective fastening part **102** has been adjusted in the axial direction, the fastening part **102** can be fastened in place on the guide part **100**. Threaded holes **118** are provided on the respective guide part **100**, by means of which threaded holes the fixing elements **116** can be screwed into the respective guide part **100**.

To align the respective transport rail **42**, **44**, **46** in the region of the respective coupling element **72**, the fastening part **102** is therefore first displaced in the axial direction in order to adjust the respective transport rail **42**, **44**, **46** in the transverse direction **54**. In this case, the screws **104** and the fixing elements **116** are released. After the respective transport rail **42**, **44**, **46** has been aligned in the transverse direction **54** in the region of the respective coupling element **72**, the screws **104** and the fastening elements **116** are tightened for fastening.

FIGS. **12** and **13** show a further embodiment in which a coupling element **120** is shown that has a different structure from the coupling element **72** shown in FIGS. **7** to **11**. In FIGS. **12** to **14**, components corresponding to FIGS. **7** to **11** are denoted by corresponding reference signs.

In order to better illustrate the functioning of the coupling member **120** in FIGS. **12** and **13**, these figures show a bottom view, which is why the toothing **66** of the respective transverse rod **56** is shown from above. Furthermore, the arrangement according to FIGS. **12** and **13** is such that the respective rotary rod **68** is not arranged between the respective transverse rod **58** and the respective transport rail **42**, **44**, **46**, but laterally next to the respective transport rail **42**, **44**, **46**. Furthermore, the respective guide element **61** is formed integrally with the respective guide part **100**.

Corresponding to the coupling elements **72**, the coupling elements **120** have, in addition to the guide part **100**, a fastening part **102** that can be adjusted on the respective transport rail **42**, **44**, **46** and can be fixed with fastening screws **104**. The fastening part **102** provides an actuating section **112** and the guide part **100** provides a counter-section **110** interacting therewith. Unlike the coupling element **72** shown in FIGS. **7** to **11**, the slot **114** is, in the case of the coupling element **120**, not provided on the fastening part **102**, but on the guide part **100** and there on the counter-section **110**. It can also be clearly seen from FIGS. **12** and **13** that the actuating section **112** is designed as a groove-like guide recess in which the counter-section **110** is displaceably arranged. According to the embodiment shown in FIGS. **7** to **11**, a fixing element **116** in the form of a fixing screw is also provided in the case of the coupling element **112**, by means of which fastening element the counter-section **110** can be fixed on the actuating section **112**.

According to the embodiment of FIGS. **7** to **11**, the actuating section **112** or the counter-section **110** according to the embodiment according to FIGS. **12** and **13** also encloses an acute angle α with the transport direction.

In order to axially align the respective transport rail **42**, **44**, **46**, according to the embodiment according to FIGS. **7** to **11**, the fastening part **102** is first adjusted in the axial direction or transport direction **18** with the screws or fixing means **104** and **116** open to such an extent that the distance in the transverse direction **54** between the respective transport rail **42**, **44**, **46** and the respective guide part **100** changes during axial adjustment of the associated fastening part **102**, specifically until the respective transport rail **42**, **44**, **46** is aligned in the axial direction in the region of the respective coupling element **120**. The fastening screws or fixing means **104** and **116** are then tightened.

The invention claimed is:

1. A transport system (**34**) for transporting soldering material through a soldering apparatus (**10**), comprising at least one transport track (**38**, **40**) extending in the transport direction (**18**), wherein the transport track (**38**, **40**) comprises at least two transport rails (**42**, **44**, **46**, **48**),

wherein a plurality of coupling elements (**72**, **120**) are provided on at least one transport rail (**42**, **44**, **46**),

wherein the coupling elements (**72**, **120**) comprise guide elements (**58**, **60**, **61**) which interact with transverse rods (**56**) which extend in a transverse direction (**54**) running transversely to the transport direction (**18**), and

wherein the coupling elements (**72**, **120**) each comprise a guide part (**100**) having the respective guide element (**58**, **60**, **61**) and a fastening part (**102**) fastened to the respective transport rail (**42**, **44**, **46**)

characterized in that

the fastening parts (**102**) are arranged on the respective transport rail (**42**, **44**, **46**) so as to be axially adjustable and fixable,

in that the fastening parts (**102**) each have an actuating section (**112**) and the guide parts (**100**) each have a counter-section (**110**) cooperating with the associated actuating section (**112**),

in that the actuating section (**112**) and/or the counter-section (**110**) form an acute angle (α) with the transport direction (**18**),

in that the fastening part (**102**) is adjustable relative to the guide part (**100**),

so that the distance in the transverse direction (**54**) between the transport rail (**42**, **44**, **46**) and the respective guide part (**100**) changes when the fastening part (**102**) is axially displaced.

2. The transport system (**34**) according to claim **1**, characterized in that the respective actuating section (**112**) bears at least in sections against the respective counter-section (**110**) in a displaceably guided manner.

3. The transport system (**34**) according to claim **2**, characterized in that the respective actuating section (**112**) or the respective counter-section (**110**) has a sliding receptacle for the respective counter-section (**110**) or the respective actuating section (**112**).

4. The transport system (**34**) according to claim **1**, characterized in that the respective actuating section (**112**) or the respective counter-section (**110**) has an elongated hole (**114**) extending in the transport direction (**18**), in which elongated hole at least one fixing element (**116**) is provided for fixing the respective guide part (**100**) to the respective fastening part (**102**).

5. The transport system (**34**) according to claim **4**, characterized in that the at least one fixing element (**116**) is designed as a fastening screw.

6. The transport system (**34**) according to claim **1**, wherein, for the width adjustment of the at least one transport track (**38**, **40**), at least one of the two transport rails (**42**, **44**, **46**, **48**) is adjustable in a transverse direction (**54**) running transversely to the transport direction (**18**), and wherein guide elements (**58**, **60**, **61**) adjacent in the transverse direction (**54**) of transport rails (**42**, **44**, **46**) adjustable in the transverse direction (**54**) are each guided on the same transverse rod (**56**) so as to be displaceable toward and away from one another in the transverse direction (**54**).

7. The transport system (**34**) according to claim **6**, characterized in that rotatably drivable rotary rods (**68**) running parallel to the transport rails (**42**, **44**, **46**, **48**) are provided, in that the coupling elements (**72**) each have a rotary receptacle (**74**) for the respective rotary rod (**68**) and in that the transverse rods (**56**) have a toothing (**66**) on their side facing the respective transport rail (**42**, **44**, **46**, **48**), which toothing meshes with gear wheels (**70**) provided on the respective rotary rods (**68**).

8. The transport system (**34**) according to claim **7**, characterized in that a motor (**62**) for rotatably driving the respective rotary rod (**68**) is provided on the respective free end of the respective rotary rod (**68**).

9. Transport system (**34**) according to claim **1**, characterized in that drivable transport chains are provided that run at least in sections in the transport rails (**42**, **44**, **46**, **48**).

10. A soldering apparatus (**10**) in which soldering material can be transported along a transport direction (**18**), comprising a transport system (**34**) according to claim **1**.

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